Appendix C
Transportation Study

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Santa Barbara Foothill Communities Community Wildfire Protection Plan

Prepared for:
Santa Barbara County Fire Department

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LA23-3499

FEHR PEERS

**While the Santa Barbara Foothill Community Wildfire Protection Plan is recommended for adoption by the Santa Barbara County Board of Supervisors, this Transportation Study is recommended as a receive and file document inserted as an Appendix to the plan.*

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A Note on Emergency Evacuation Assessments

This document is intended to provide an assessment of roadway capacity and time needed to evacuate under the described evacuation scenarios. Please note that emergency evacuation can occur due to any number of events. Additionally, any emergency movement is unpredictable because it has an element of individual behavior related to personal risk assessment for each hazard event as the associated evacuation instructions are provided. As such, this assessment is intended to provide the Santa Barbara County Fire Department (SBC Fire) and the plan area with a broad understanding of the capacity of the transportation system during an evacuation scenario; it does not provide a guarantee that evacuations will follow modeling that is used for analysis purposes, nor does it guarantee that the findings are applicable to any or all situations. Moreover, as emergency evacuation assessment is still an emerging field, there is not yet an established standard methodology. Fehr & Peers has adopted existing methodologies in transportation planning that, based on our knowledge and experience, we believe are the most appropriate within the limits presented by the tools and data available, the budgetary and time constraints in the scope of work, and by current knowledge and state of the practice. While this assessment should help SBC Fire better prepare for hazard related events and associated evacuations, SBC Fire should take care in planning and implementing any potential evacuation scenario. Fehr & Peers cannot and does not guarantee the efficacy of any of the information from this assessment as such would be beyond our professional duty and capability.

1. Introduction

1.1 Background

This report ("Transportation Study") evaluates the expected travel demand and roadway capacity under evacuation conditions in the Santa Barbara Foothill Communities ("plan area") in support of the Community Wildfire Protection Plan (CWPP). Based on the results of the evacuation analysis, areas were identified that may have limited access and egress during an evacuation event and recommendations were developed to improve emergency access and resident/worker/visitor evacuations.

The Transportation Study and CWPP were developed in close partnership with the Santa Barbara County Fire Department (SBC Fire), and with input from local organizations (via monthly stakeholder meetings) and from community members (via two in-person workshops and a public survey). The evacuation analysis relied on demographic information from the U.S. Census and roadway information from the County of Santa Barbara (County). The CWPP—developed by Dudek in parallel with the Transportation Study—evaluates wildfire hazard and risk in the plan area to identify areas for hazardous fuel reduction treatments, and measures to reduce wildfire risk and increase wildfire preparedness. The County of Santa Barbara is conducting a broader countywide evacuation study concurrently.

1.2 Study Area Overview

The plan area is located north of the City of Santa Barbara in Unincorporated Santa Barbara County. The developed areas are comprised of the Mission Canyon community and the area immediately north of Foothill Road between San Marcos Pass Road and Northridge Road. These areas are primarily zoned for single family residential development and recreation. The remainder of the plan area is largely undeveloped and zoned for agricultural use and resource protection. Most of the undeveloped areas fall on Los Padres National Forest land. When estimating travel demand, the evacuation analysis included developed areas immediately adjacent to the plan area, referred to in this report as "shadow regions". These shadow regions were included to account for nearby populations that may evacuate voluntarily along the same transportation corridors as the plan area, without receiving a direct evacuation order, thereby adding to the number of vehicles considered in each evacuation scenario. **Figure 1** illustrates the plan area, along with the shadow regions, which together make up the analysis area.

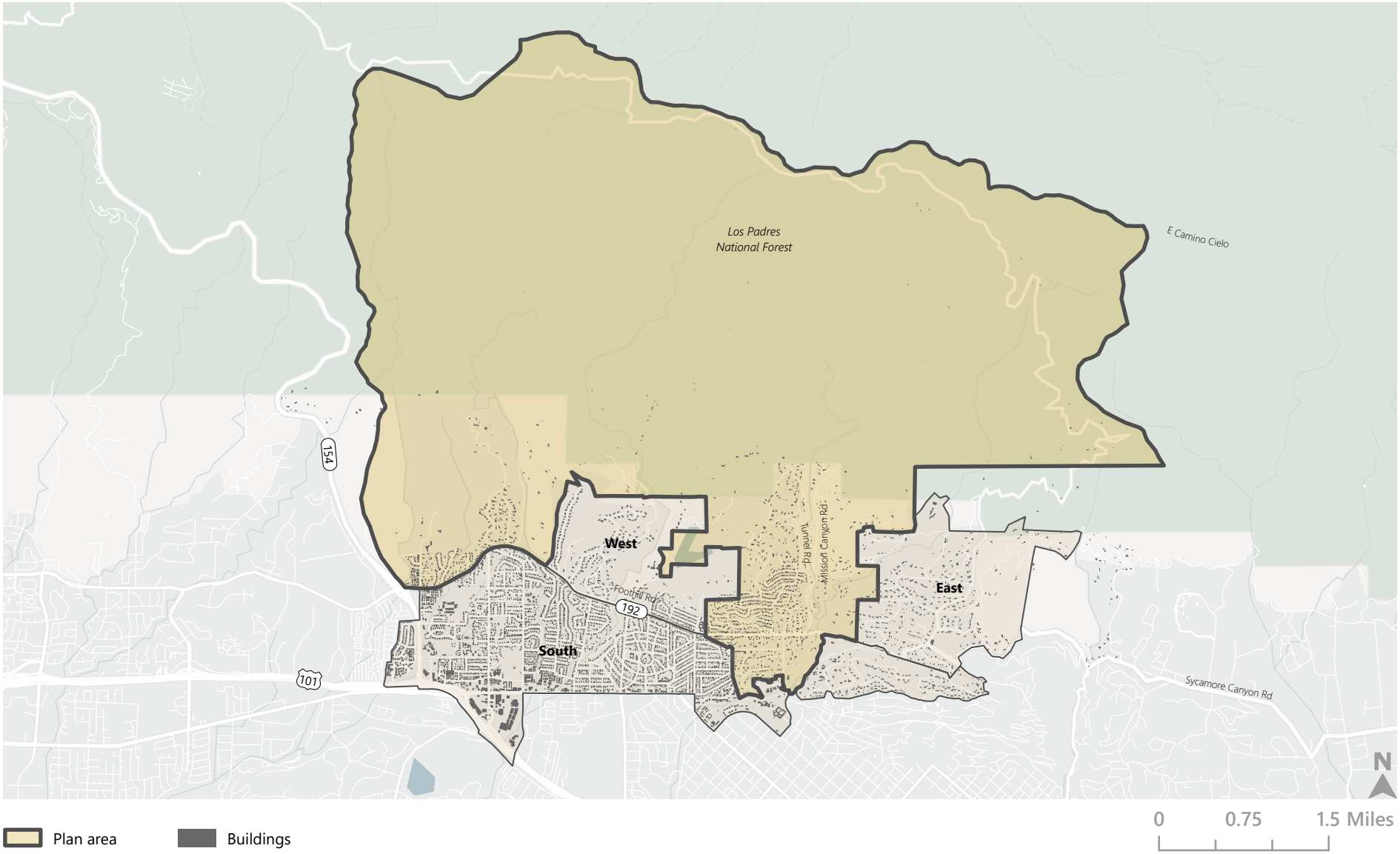

Figure 1

Analysis Area

The plan area has a residential population of approximately 3,500 people across approximately 1,400 households, according to 2022 American Community Survey (ACS) five-year estimates. The residential population is concentrated in the developed areas described above, though there are a limited number of households in the northwest portion of the plan area along Gibraltar Road. **Table 1** breaks down the residential population by demographic and employment characteristics. Approximately 40% of the residential population is employed and another 11% is school age. Nearly a quarter of the population is aged 65 and over. These characteristics are relevant when estimating the population in the plan area at different times of the day and week and were therefore factored into the evacuation analysis discussed in **Chapter 2**. Due to the higher density of development south of Foothill Road, the residential population of the analysis area is substantially larger, with approximately 24,000 people across 10,000 households.

Table 1: Plan Area Residential Population Characteristics

	Plan Area Estimates	Share of Plan Area Population
Total population[1]	3,500	100%
Population under 5 years of age	276	8%
Population ages 5-18	373	11%
Population ages 65 and over	831	24%
Persons with disabilities	202	6%
Total employed population[2]	1,350	39%
Employed population that works from home[3]	300	9%

Note:
[1]Includes permanent residential population and the estimated average daily population of residents whose second home is in the study area.
[2]Refers to people who live in the study area and are employed. Their employer may or may not be located within the study area.
[3]Calculated using telework estimates by industry from the BLS "Telework, Hiring, and Vacancies – 2022" report and employment data from LEHD Origin-Destination Employment Statistics 2021 Residential Area Characteristics.
Source: 2022 ACS 5-Year estimates; 2021 LEHD Origin-Destination Employment Statistics Residential Area Characteristic.

The non-residential population that may need to evacuate in the event of a wildfire includes people employed within the plan area, and daytime visitors. Approximately 325 jobs are located within the plan area, with most employees commuting in from other parts of the County.[1] Top industries include healthcare and social assistance, entertainment and recreation, and construction. The southeast portion of Mission Canyon has the highest job density in the plan area. The number of jobs in the plan area was estimated using data from the 2021 Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics Workplace Area Characteristics and FEMA USA Structures. In addition, Fehr & Peers developed a methodology to estimate the number of private household-employed workers (e.g. yard/landscape workers, housekeepers, etc.), which are historically underrepresented in Census employment data.[2, 3] The analysis area has nearly 10,000 jobs, half of which are concentrated along State Street between La Cumbre Road and Hope Avenue. Daytime visitor volumes were estimated based on approximate daily attendance of the study area's major attractions: the Santa Barbara Botanic Garden in Mission Canyon and the trailheads scattered throughout the undeveloped portions of the plan area.[4] Note, the Santa Barbara Botanic Garden is required to be closed on "red flag" days where the risk of wildfire is high; therefore, the inclusion of visitors to this site in this analysis reflects a "worst case" scenario for an unanticipated wildfire that emerges and spreads suddenly. As with the residential population, day of week and time of day would impact the size of the non-residential population that may need to evacuate, which was considered in the evacuation analysis.

1.3 Organization of Report

This report is divided into four chapters, including this introduction. **Chapter 2** describes the evacuation analysis, with sections on roadway capacities, the methodology for estimating evacuation travel demand, and the evacuation model results. **Chapter 3** describes recommendations for improving emergency access and resident/worker/visitor evacuations. **Chapter 4** summarizes the report's findings and discusses opportunities to build upon this work.

[1] Approximately two percent of workers in the plan area live in the plan area as well according to Census OnTheMap 2021 data.

[2] UCLA Labor Center, "Profile of Domestic Workers in California," 2020.

[3] A brief literature review was conducted to understand how many household workers may be employed in households of different income levels and were unable to find anything conclusive. Therefore, a simplified approach was taken to estimate this figure. Private household-employed workers were estimated by assuming households located in top 25th percentile median household income block groups employ one private household worker per week on average.

[4] The Botanic Garden parking lot was assumed to be at capacity on weekends and at 72% capacity on weekdays, based on a comparison of weekday vs. weekend daily attendance data for June – September 2023. Parked vehicles were counted via a weekday afternoon site visit and supplemented with Google Street View for Inspiration Point Trailhead, Rattlesnake Canyon Trailhead, Jesusita Trailhead, and the parking area for San Marcos Foothill Preserve. Weekend trail parking occupancy was estimated to be double that of weekday trail parking occupancy counts.

2. Evacuation Assessment

A goal of the Transportation Study was to estimate the amount of time it may take to evacuate the plan area and use this data to identify potential bottlenecks in the transportation network. To this end, Fehr & Peers examined the roadway capacities of the evacuation routes in the plan area and compared them to the expected evacuation travel demand under different evacuation scenarios.

2.1 Roadway Capacity

The capacity of the evacuation roadway network was evaluated to understand how many vehicles per lane per hour could potentially evacuate along different routes during an evacuation event.

2.1.1 Evacuation Routes

The surrounding topography restricts the number of evacuation routes connecting the Santa Barbara Foothill Communities to State Route 154, State Route 192, and Highway 101. Santa Barbara County has identified regional evacuation routes, and those within the plan area are described and examined below. Unpaved, private roads are not included in this evacuation analysis but are revisited in **Chapter 3** in the context of study recommendations. This analysis focuses on evacuation by personal vehicles; there are currently no designated bike facilities within the study area, and many of the roads lack sidewalks.

- **Foothill Road**, also known as State Route 192, runs east-west along the southern portion of the plan area and through Mission Canyon. Foothill Road provides access to State Route 154 and Highway 101 to the west, and to State Route 150 and Highway 101 to the east, near the Ventura County line.
- **Mission Canyon Road** is a north-south road that connects residences in northeastern and southeastern portions of Mission Canyon to Foothill Road. Mission Canyon Road extends into the northern limits of the developed areas of Mission Canyon, provides access to the Santa Barbara Botanic Garden, and connects to the City of Santa Barbara to the south.
- **Tunnel Road** is a north-south road that connects residences in northwestern portions of Mission Canyon to Mission Canyon Road. Tunnel Road extends into the northern limits of the developed areas in Mission Canyon, terminating at the Tunnel Road trailhead. Tunnel Road merges into Mission Canyon Road a quarter mile north of Foothill Road.
- **Cheltenham Road** is a narrow, winding road that connects the more densely developed western half of Mission Canyon north of Foothill Road to Foothill Road—both directly and via Tye Road. Cheltenham Road also connects to Tunnel Road to the north.
- **Las Canoas Road** is a narrow east-west road that connects the eastern portion of Mission Canyon east of Mission Canyon Road to Mission Canyon Road.
- **Camino Cielo Road** is a narrow east-west road that runs along the northern edge of the study area. The road connects to State Route 154 to the west and to Gibraltar Road to the east. Camino Cielo Road provides access to Tunnel Trailhead and the Arroyo Burro Trail.

- **Gibraltar Road** is a narrow, winding north-south road that connects Camino Cielo Road in the northwest portion of the study area to State Route 192 just east of Mission Canyon. Gibraltar Road provides access to the Gibraltar Rock climbing area, Rattlesnake Canyon Trail, and the West Fork Trailhead.

Nearly half of the neighborhoods in the plan area have single points of access and egress; these areas are primarily residential. Constrained neighborhoods include the residential areas west of La Cumbre Road, homes along San Roque Road north of Foothill Road, and much of the Mission Canyon community north of Foothill Road. **Figure 2** illustrates the broader network of evacuation routes in the analysis area and highlights neighborhoods with single access points.

2.1.2 Evacuation Route Capacity

Using metrics provided in the Santa Barbara County Comprehensive Plan Circulation Element (Circulation Element), roadway capacity was estimated in terms of vehicles per lane per hour for all evacuation routes in the analysis area. All evacuation routes in the analysis area met the Circulation Element roadway classification definition for either a two-lane major road or a collector road. The Circulation Element indicates the policy capacity of a two-lane major road is 10,000 Average Daily Traffic (ADT) and the policy capacity of a collector road is 5,000 ADT. Policy capacity refers to the average amount of traffic that policy makers deem "acceptable" on a particular category of roadway. Design capacity, on the other hand, is the amount of traffic a particular roadway can support based on its physical design.[5] It is useful to understand a roadway's full design capacity in an evacuation scenario, so the ADT for each roadway type (as defined in the Circulation Element) was divided by 0.8 to estimate each roadway's design capacity.[6] This approach resulted in an estimated design capacity of 12,500 ADT for two-lane major roads and 6,250 ADT for collector roads. To calculate the hourly capacity per lane, a metric called the K-Factor was applied to the ADT for each roadway type; this analysis used a K-factor of 0.12.[7] This approach resulted in a vehicle per lane per hour capacity of 375 for collector roads and 750 for two-lane major roads. However, given the actual context of the roadways in question, a vehicle per lane per hour capacity of 375, which implies six vehicles per minute in a single direction, is unrealistically low as a design capacity.

The evacuation scenarios being studied do not reflect normal operations, which makes the policy capacity less relevant to the questions at hand. In the absence of detailed figures for maximum design capacity, and given the specific roadway characteristics, the analysis relied on the assumption that all evacuation routes in the analysis area would operate with the capacity of a two-lane major road as defined by the Circulation

[5] Design capacity refers to the maximum amount of Average Daily Traffic (ADT) that a given roadway can accommodate, based upon roadway design—in this case determined by the Santa Barbara County Public Works Department. Design Capacity usually equates to Level of Service (LOS) E/F.

[6] Per the County's public guidelines, the policy capacity was interpreted as corresponding to 80% of design capacity.

[7] The K-Factor is a metric that helps convert ADT to hourly volumes. It refers to the proportion of ADT on a roadway segment or link during the Design Hour, which is the hour in which the 30th highest hourly traffic flow of the year takes place and can be used to convert ADT to hourly volumes. The K-Factor typically ranges from 7% to 12% depending on whether a facility is in an urban, suburban, or rural area. In this case, a higher K-Factor was used due to relatively low level of density in the plan area.

Element. To be conservative, a 20% capacity reduction was applied to account for capacity constraints related to smoky conditions and navigability issues that could arise during a wildfire event. These calculations resulted in an evacuation roadway capacity of 600 vehicles per lane per hour for all evacuation routes in the analysis area.

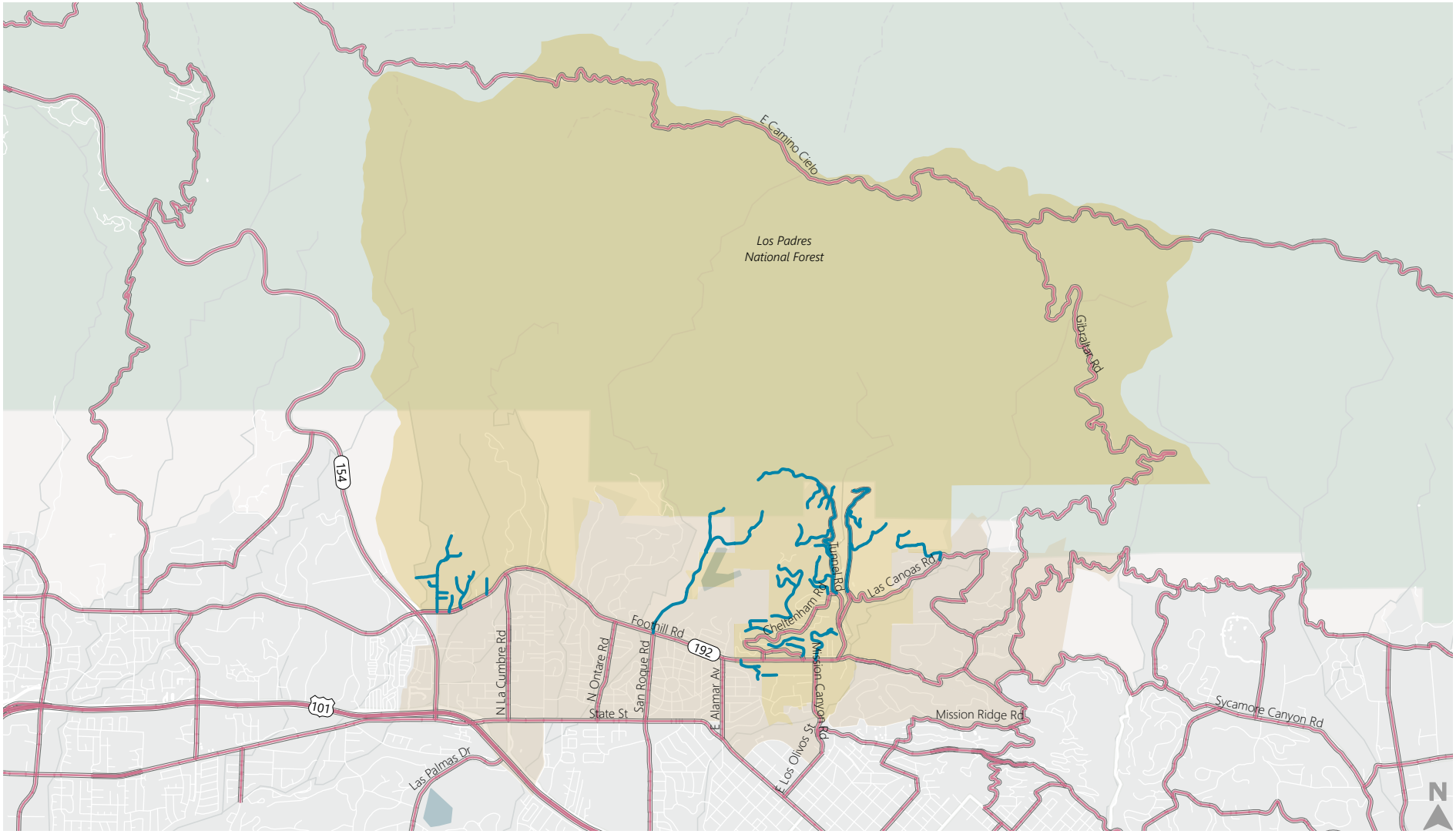

Figure 2

County Evacuation Routes and Single Access Points

2.2 Evacuation Travel Demand

To determine travel demand under evacuation conditions, the project team looked at six different scenarios and calculated the number of evacuating vehicles per building/recreational facility for each. Travel demand measures how many vehicles may use a roadway at a specific time.

2.2.1 Evacuation Scenarios

The evacuation analysis considered three ignition point locations and two times of the week to evaluate a total of six evacuation scenarios. In the most extensive evacuation scenario, which assumes an ignition point located centrally in the plan area, a wildfire event would require the entire plan area and much of the analysis area to evacuate. Ignition points in the western and eastern portions of the plan area that would result in a smaller share of the total plan area evacuating were also considered. **Table 2** summarizes the evacuation scenario parameters.

Table 2: Assumed Share of Population Evacuating Analysis Area by Scenario

Scenario	Ignition Point	Day of Week	Share of Population Evacuating							
			Plan Area Evacuation Zone 1	Plan Area Evacuation Zone 2	Plan Area Evacuation Zone 3	Plan Area Evacuation Zone 4	Plan Area Evacuation Zone 5	Shadow Region West	Shadow Region South	Shadow Region East
1	Central	Weekday	100%	100%	100%	100%	100%	100%	50%	100%
2	Central	Weekend	100%	100%	100%	100%	100%	100%	50%	100%
3	Western	Weekday	100%	100%	30%	30%	30%	100%	50%	30%
4	Western	Weekend	100%	100%	30%	30%	30%	100%	50%	30%
5	Eastern	Weekday	30%	30%	100%	100%	100%	100%	50%	100%
6	Eastern	Weekend	30%	30%	100%	100%	100%	100%	50%	100%

For each of the six scenarios, the evacuation travel demand estimates considered day and time of week by estimating demand on a **weekday afternoon** versus a **weekend midday**. These times were selected because they reflect contexts in which different shares of residential and non-residential populations would be in the plan area and reacting to an evacuation order. On a **weekday afternoon**, employed residents and school-age residents were expected to be outside of the plan area (at work and school, respectively); people who work in the plan area were expected to be in the plan area; visitors were expected to be present but at lower levels relative to a weekend. On a **weekend midday**, most of the residential population was expected to be home; workers in a subset of industries—such as *entertainment and recreation* and *accommodation and food services* (per NAICS)—were expected to be in the plan area; visitor volumes were expected to be at their peak levels. A weeknight scenario was also considered. However, this scenario had a similar profile to a weekend midday scenario but with fewer workers and visitors present. To be more conservative, this analysis chose to estimate travel demand for the midday weekend scenario.

2.2.2 Demand Estimation Methodology

To calculate evacuation travel demand, Fehr & Peers developed a methodology to estimate the number of evacuating vehicles and assign vehicles to evacuation routes. The analysis relied on the official County of Santa Barbara evacuation routes discussed in **Section 2.1.1**. The first step used FEMA USA Structures data to estimate the number of evacuating vehicles per building. The per-building figures for different kinds of buildings (single family residential, multifamily residential, non-residential) were used to estimate the total number of vehicles that would potentially evacuate the analysis area under each scenario.[8] Next, the analysis area was divided into smaller zones. Each of these zones was assigned to evacuation routes along the evacuation route network. Then, using Vistro analysis software, the cumulative number of evacuating vehicles at different geographic points of analysis (screenlines) along the evacuation network within the analysis area was estimated.

For **residential buildings**, in both weekday and weekend scenarios, the number of evacuating vehicles was estimated on a per dwelling unit basis. Dwelling units in multi-family buildings were estimated by dividing the square footage of the building by an average unit size of 800 square feet.[9] For the **weekday** scenarios, the average number of residents that would be home on a weekday was used as a proxy for the number of evacuating vehicles for each dwelling unit. To estimate the average number of residents that would be home on a weekday in a given unit, the share of residents who are employed and do not work from home, as well as the share of school-age residents, was subtracted from the average household size. For residential buildings in top 25th percentile median income Census block groups, the estimated number of private household-employed workers was added to the evacuating vehicle estimate. For the **weekend** scenarios, the average number of household vehicles was used to estimate the number of evacuating vehicles per dwelling unit.

For **non-residential buildings**, each job corresponded to one evacuating vehicle. While ACS data indicates that some people carpool or use alternative modes of transportation, this represents a small share of commuters. So, to be conservative, it was assumed that all workers drove alone to work. For the **weekday** scenarios, the number of jobs per non-residential building was estimated by dividing the number of jobs in a Census block ("block") by the number of non-residential buildings in the corresponding block, so all non-residential buildings within a block had the same number of estimated average jobs. Although work patterns shift throughout the week, this approach reflects an average weekday. For the **weekend** scenarios, the number of jobs was adjusted to only include industries that are most likely to work on the weekends. For these scenarios, the number of jobs in each block was multiplied by the share of jobs in that block that are classified as *entertainment and recreation* or *accommodation and food services* (per NAICS) for the weekend scenario. **Table 3** summarizes these assumptions by population and time of week.

[8] Assumptions and methods were developed using data from the plan area only, and applied to shadow zones on a per-dwelling unit and per-non-residential building basis

[9] The average unit size was determined by calculating the average square footage of multifamily units available for rent within the plan area on real estate websites such as Zillow and Apartments.com. Assuming a larger average unit size would result in lower estimated evacuation travel demand.

Table 3: Estimated Number of Evacuating Vehicles Per Building

	Weekday Afternoon	Weekend Midday
Residential building		
Residential vehicles per dwelling unit	1.5	2.1
Private household employed worker vehicles	0.2[1]	0
Non-residential building		
Worker vehicles	28 (per building average)	2.5 (per building average)

Note: [1]Applied to households in top 25th percentile median income block groups only and assumes these households employ one private household-employed worker per week on average.

Next, the analysis area was divided into smaller zones to calculate the portion of the above evacuating vehicle demand that fell within each zone. The zones were determined by clustering buildings such that it would be reasonable to assume all the evacuating vehicles within a zone would turn out onto the same evacuation route segment during an evacuation event. For each zone, evacuation vehicle trips were assigned to the evacuation route network based on the ignition point and the closest intersection to each zone. It was assumed that drivers would prioritize getting south of Foothill Road as quickly as possible, and would make right turns over left turns where possible (avoiding more challenging turns with conflicting vehicle movements).

The final step was to examine how the calculated demand for different zones might interact with existing evacuation routes. Screenlines were mapped at the approach in each direction for each intersection of evacuation route segments throughout the analysis area. The cumulative number of evacuating vehicles that would potentially pass through each screenline when evacuating the analysis area was analyzed using Vistro analysis software. This analysis was performed for the six evacuation scenarios described in **Section 2.2.1**.[10] **Figure 3** illustrates the boundaries of the trip assignment zones and the placement of the screenlines.

2.2.3 Evacuation Travel Demand Estimates

The evacuation travel demand results provide an estimated number of evacuating vehicles at each screenline in each scenario. **Table 4** summarizes the results in terms of number of evacuating vehicles. Overall, greater evacuation travel demand is expected under a weekend scenario compared to a weekday scenario. The total estimated number of evacuating vehicles is similar under a central and eastern ignition point (Scenarios One, Two, Five and Six) and lower under a western ignition point (Scenarios Three and Four).

[10] For each zone, the number of estimated vehicles per building was summed under a weekday and weekend scenario, and vehicles associated with the Santa Barbara Botanic Gardens and four trailheads were added where applicable. Evacuation assumptions associated with how each of the three ignition points might affect evacuation behaviors were then applied, and used to generate six evacuation travel demand estimates.

When considering the entire analysis area, evacuation travel demand is expected to be highest south of Foothill Road going southbound along La Cumbre Road, Ontare Road, Alamar Avenue, and Los Olivos Street due to the cumulative traffic from the plan area and the southern shadow region. Within the plan area, evacuation travel demand is expected to be highest heading southbound on Mission Canyon Road south of Foothill Road.

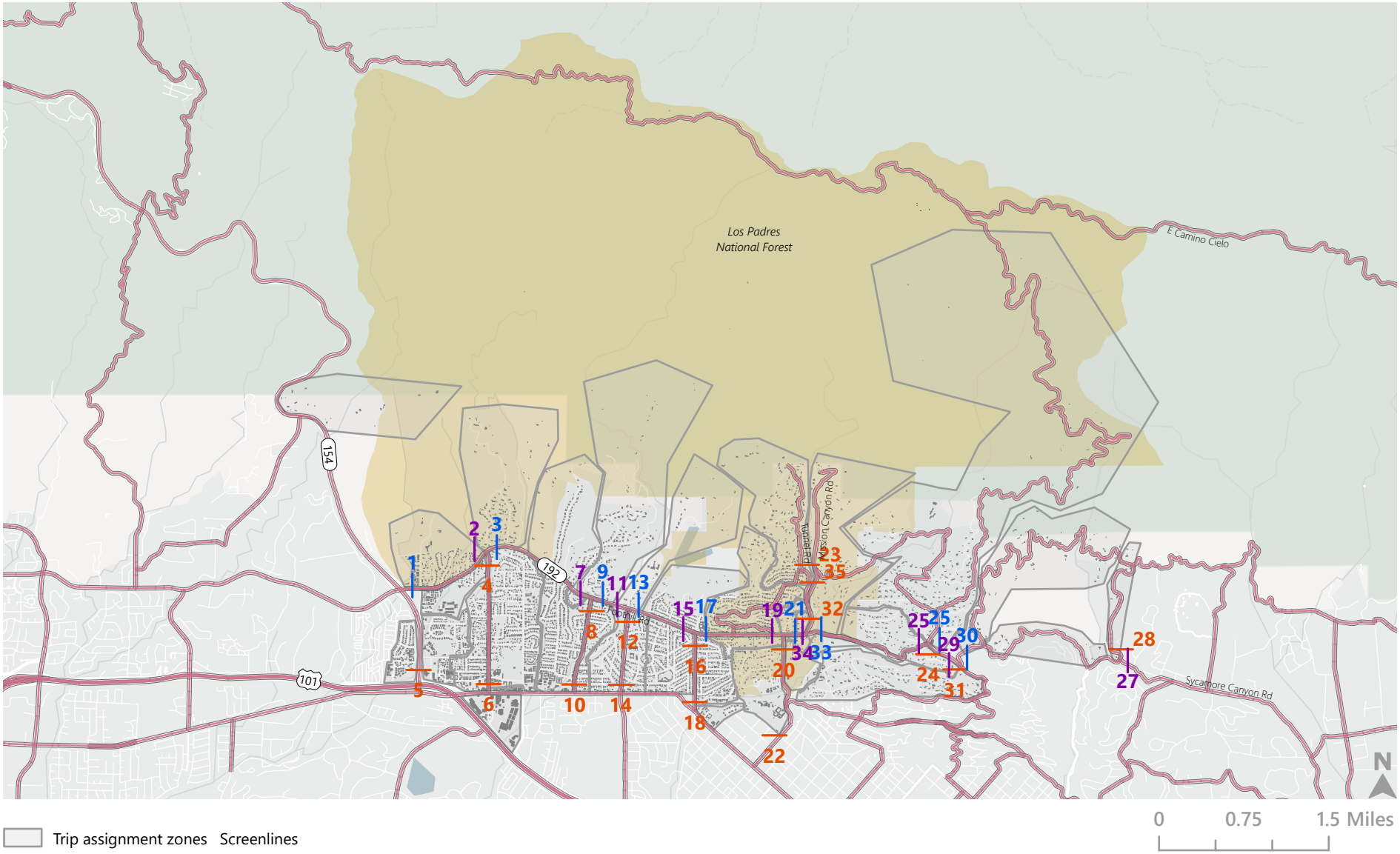

Figure 3

Trip Assignment Zones and Screenlines for Evacuation Travel Demand Estimation

Table 4: Estimated Evacuation Vehicle Demand by Screenline and Evacuation Scenario

Screenline (Direction)	Road Name	Number of Vehicles - Weekday			Number of Vehicles - Weekend		
		Scenario 1	Scenario 3	Scenario 5	Scenario 2	Scenario 4	Scenario 6
1 (WB)	Foothill Rd	413	413	212	474	474	247
2 (EB)	Foothill Rd	318	318	184	366	366	215
3 (WB)	Foothill Rd	291	291	155	359	359	193
4 (SB)	N La Cumbre Rd	609	609	339	725	725	408
5 (SB)	Hwy 154	479	479	232	538	538	266
6 (SB)	N La Cumbre Rd	2,805	2,805	2,535	2,292	2,292	1,975
7 (EB)	Foothill Rd	112	112	112	144	144	144
8 (SB)	N Ontare Rd	420	420	420	459	459	459
9 (WB)	Foothill Rd	0	0	0	0	0	0
10 (SB)	N Ontare Rd	1,100	1,100	1,100	1,236	1,236	1,236
11 (EB)	Foothill Rd	0	0	0	0	0	0
12 (SB)	San Roque Rd	278	83	278	309	93	309
13 (WB)	Foothill Rd	197	59	197	203	61	203
14 (SB)	San Roque Rd	707	512	707	778	562	778
15 (EB)	Foothill Rd	0	0	0	0	0	0
15 (WB)	Foothill Rd	197	59	197	203	61	203
16 (SB)	E Alamar Av	599	180	599	719	216	719
17 (WB)	Foothill Rd	468	141	468	583	175	583
18 (SB)	E Alamar Av	1,451	1,032	1,451	1,669	1,166	1,669
19 (EB)	Foothill Rd	407	122	407	507	152	507
20 (SB)	Mission Canyon Rd	1,595	496	2,068	1,969	609	2,562
21 (WB)	Foothill Rd	1,128	356	1,601	1,387	434	1,980
22 (SB)	E Los Olivos St	1,965	607	2,438	2,351	723	2,944
23 (SB)	Tunnel Rd	372	112	372	478	143	478
24 (SB)	W Mountain Dr	459	138	459	581	174	581
25 (WB)	Mission Ridge Rd	64	19	164	78	23	201
25 (EB)	Mission Ridge Rd	286	86	0	362	108	0
26 (EB)	W Mountain Dr	87	30	0	108	37	0

Screenline (Direction)	Road Name	Number of Vehicles - Weekday			Number of Vehicles - Weekend		
		Scenario 1	Scenario 3	Scenario 5	Scenario 2	Scenario 4	Scenario 6
26 (WB)	W Mountain Dr	229	69	515	290	87	652
27 (EB)	Sycamore Canyon Rd	611	252	94	747	298	99
28 (SB)	Coyote Rd	35	10	35	44	13	44
29 (EB)	Mission Ridge Rd	0	0	44	0	0	55
29 (WB)	Mission Ridge Rd	94	94	94	99	99	99
30 (EB)	Mission Ridge Rd	373	116	0	470	145	0
30 (WB)	Mission Ridge Rd	64	19	164	78	23	201
31 (SB)	Stanwood Dr	64	19	208	78	23	256
31 (NB)	Stanwood Dr	467	210	94	569	244	99
32 (SB)	Mission Canyon Rd	667	201	667	811	243	811
33 (WB)	Foothill Rd	396	135	869	495	166	1,088
34 (WB)	Foothill Rd	396	135	869	495	166	1,088
34 (EB)	Foothill Rd	0	0	0	0	0	0
35 (SB)	Mission Canyon Rd	295	89	295	333	100	333

Note: Screenlines with zero estimated vehicles are the result of trip distribution assumptions for individual zones. For example, all traffic east of Screenline 9 was assigned to evacuate via San Roque Road or north-south evacuation routes east of San Roque Road, so no westbound traffic is expected to pass through Screenline 9.

2.3 Evacuation Analysis Results

The relationship between demand and capacity at various points throughout the analysis area helps determine how much time would be required for all evacuating vehicles to clear each point. As such, the next phase of the evacuation analysis compared the estimated evacuation travel demand to the roadway capacity at each screenline under evacuation conditions. The figures in this section illustrate the results of the analysis, which are presented in terms of the total number of hours it could take for all evacuating vehicles to clear each screenline from the time the first vehicle begins to evacuate following the evacuation order until the last vehicle crosses the screenline. These estimates therefore represent the cumulative amount of time for every evacuating vehicle to cross a given screenline, not the time an individual vehicle may require to evacuate. The analysis assumes a conservative, worst-case scenario where all residents, workers, and visitors would need to evacuate immediately. The time estimates do not include any preparatory time that a person may require before getting into their vehicle.

This analysis assumed no background traffic on evacuation routes as the portion of Foothill Road within the analysis area would be closed to through-traffic under an emergency evacuation order, and segments north of Foothill Road do not serve through-traffic as they only have one point of access/egress. Intersection and

segment level of service—a measure of the quality of traffic flow—under evacuation conditions was not evaluated. Across scenarios, the analysis identified four points along the evacuation route network within the plan area with the greatest evacuation traffic. The estimated time for residents, workers, and visitors located upstream to pass through these points during an evacuation event is summarized in **Table 5**. Scenario-specific findings are discussed in more detail below.

Table 5: Estimated Time to Clear Screenline During an Evacuation Event

Screenlines with Greatest Expected Traffic	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Mission Canyon Road (southbound) *Between Foothill Road and Alameda Padre Serra*	2-3 hours	3-4 hours	<1 hour	1-2 hours	3-4 hours	4-5 hours
Foothill Road (westbound) *Between southern and northern legs of Mission Canyon Road*	1-2 hours	2-3 hours	<1 hour	<1 hour	2-3 hours	3-4 hours
Mission Canyon Road (southbound) *Between Tunnel Road and Foothill Road*	1-2 hours	1-2 hours	<1 hour	<1 hour	1-2 hours	1-2 hours
Foothill Road (westbound) *Between Mission Canyon Road and Mountain Drive*	<1 hour	<1 hour	<1 hour	<1 hour	1-2 hours	1-2 hours

2.3.1 Scenarios One & Two – Central Ignition Point

Scenarios One and Two assume the entire plan area would be ordered to evacuate. In these scenarios, the analysis predicts traffic may be greatest on:

- **Mission Canyon Road** – heading southbound after Tunnel Road and Mission Canyon merge
- **Foothill Road** – heading westbound to turn south onto Mission Canyon Road
- **Mission Canyon Road** – south of Foothill Road heading southbound

The results suggest that everyone evacuating from the single access residential areas along Tunnel Road north of Cheltenham Road and along Mission Canyon Road north of Las Canoas Road would be able to reach Foothill Road within two hours. However, the analysis suggests it could take vehicles between three and four hours to pass through the intersection at Foothill Road and Mission Canyon Road to continue south on Mission Canyon Road. **Figure 4** and **Figure 5** compare the estimated time to evacuate on a weekday as opposed to a weekend. As discussed in **Section 2.2**, greater evacuation travel demand is expected under a weekend scenario compared to a weekday scenario. This greater demand is also reflected in longer evacuation times on weekends.

2.3.2 Scenarios Three & Four – Western Ignition Point

Scenarios Three and Four describe scenarios with a western ignition point. The analysis estimates evacuation travel demand for a western ignition point to be lower than the predictions for either of the other two ignition points. In Scenarios Three and Four, all portions of the plan area are expected to be able to evacuate within an hour. Traffic is expected to be greatest on **Mission Canyon Road**, south of Foothill Road heading southbound. **Figure 6** and **Figure 7** compare the estimated time to evacuate under a weekday versus a weekend scenario.

2.2.3 Scenarios Five and Six – Eastern Ignition Point

Although overall estimated evacuation travel demand is highest under the central ignition point scenarios, the eastern ignition scenarios produce the greatest level of localized traffic in the Mission Canyon portion of the plan area. Scenarios Five and Six assume traffic from the eastern shadow region would take Foothill Road westbound to Mission Canyon Road, as opposed to heading eastbound on Foothill Road, which would impact traffic flow. Traffic is expected to be greatest on:

- **Mission Canyon Road** – heading southbound after Tunnel Road and Mission Canyon merge
- **Foothill Road** – heading westbound to turn south onto Mission Canyon Road
- **Mission Canyon Road** – south of Foothill Road heading southbound

Even with the predicted impacts of an eastern ignition, the results still suggest that people evacuating the single access residential areas along Tunnel Road north of Cheltenham Road and along Mission Canyon Road north of Las Canoas Road would be able to reach Foothill Road within two hours, though the analysis suggests it could take vehicles between four and five hours to pass through the intersection at Foothill Road and Mission Canyon Road to continue south on Mission Canyon Road. **Figure 8** and **Figure 9** compare the estimated time to evacuate under a weekday and weekend scenario. The area with the greatest risk of a bottleneck is at the **intersection of Foothill Road and Mission Canyon Road**, for traffic heading southbound on Mission Canyon Road south of Foothill Road.

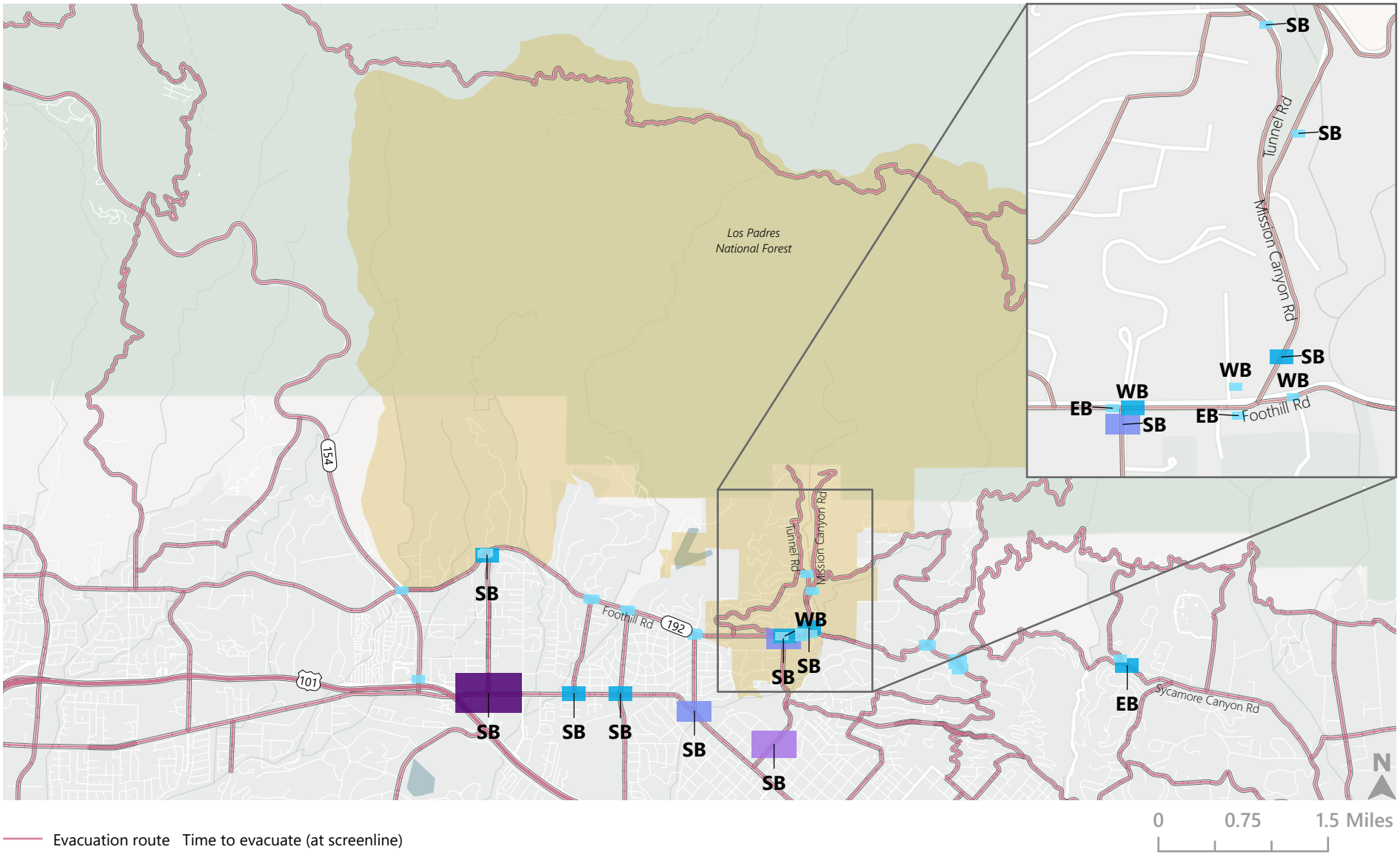

Figure 4

Scenario One Evacuation Analysis Results (Central ignition point, weekday)

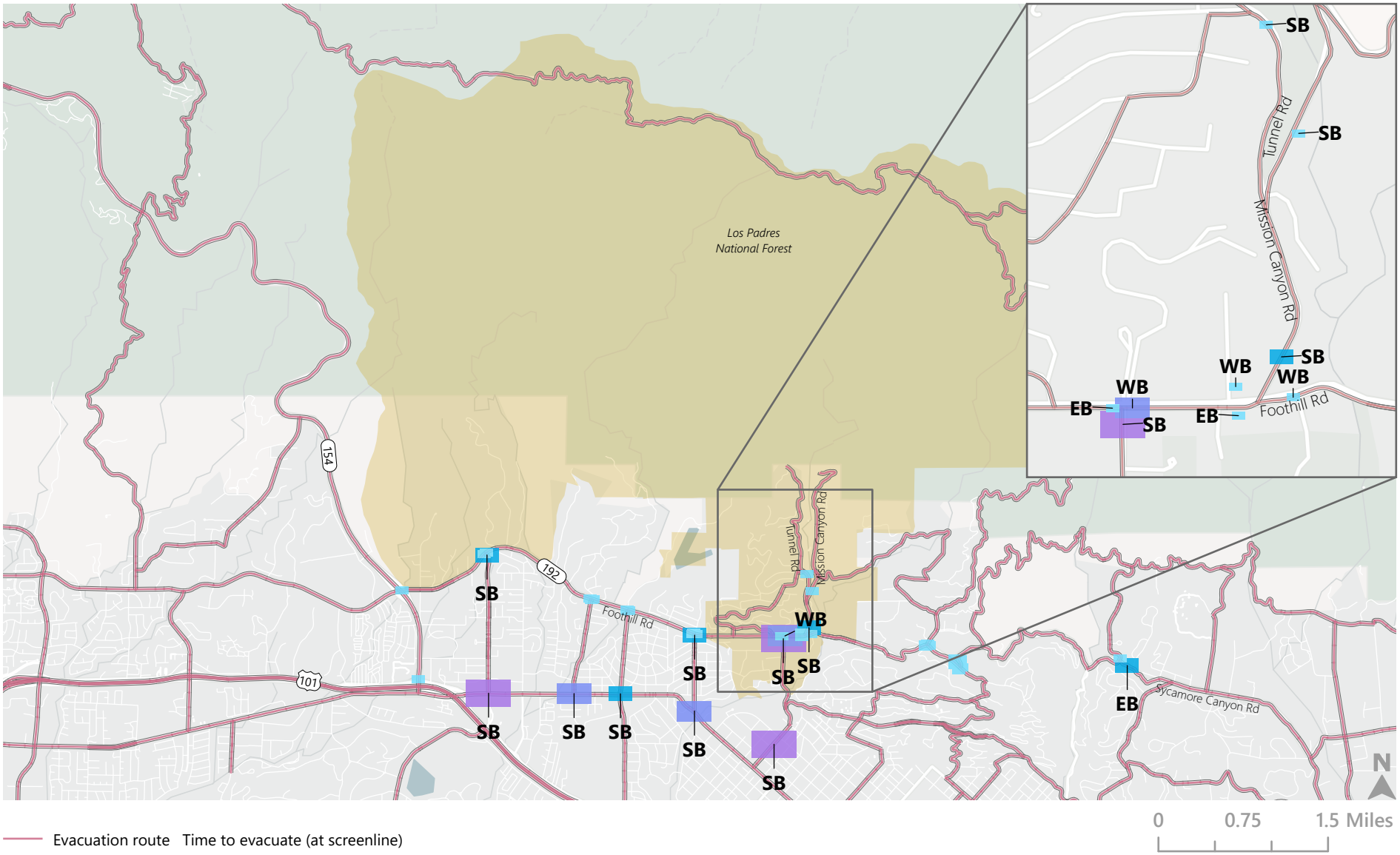

Figure 5

Scenario Two Evacuation Analysis Results (Central ignition point, weekend)

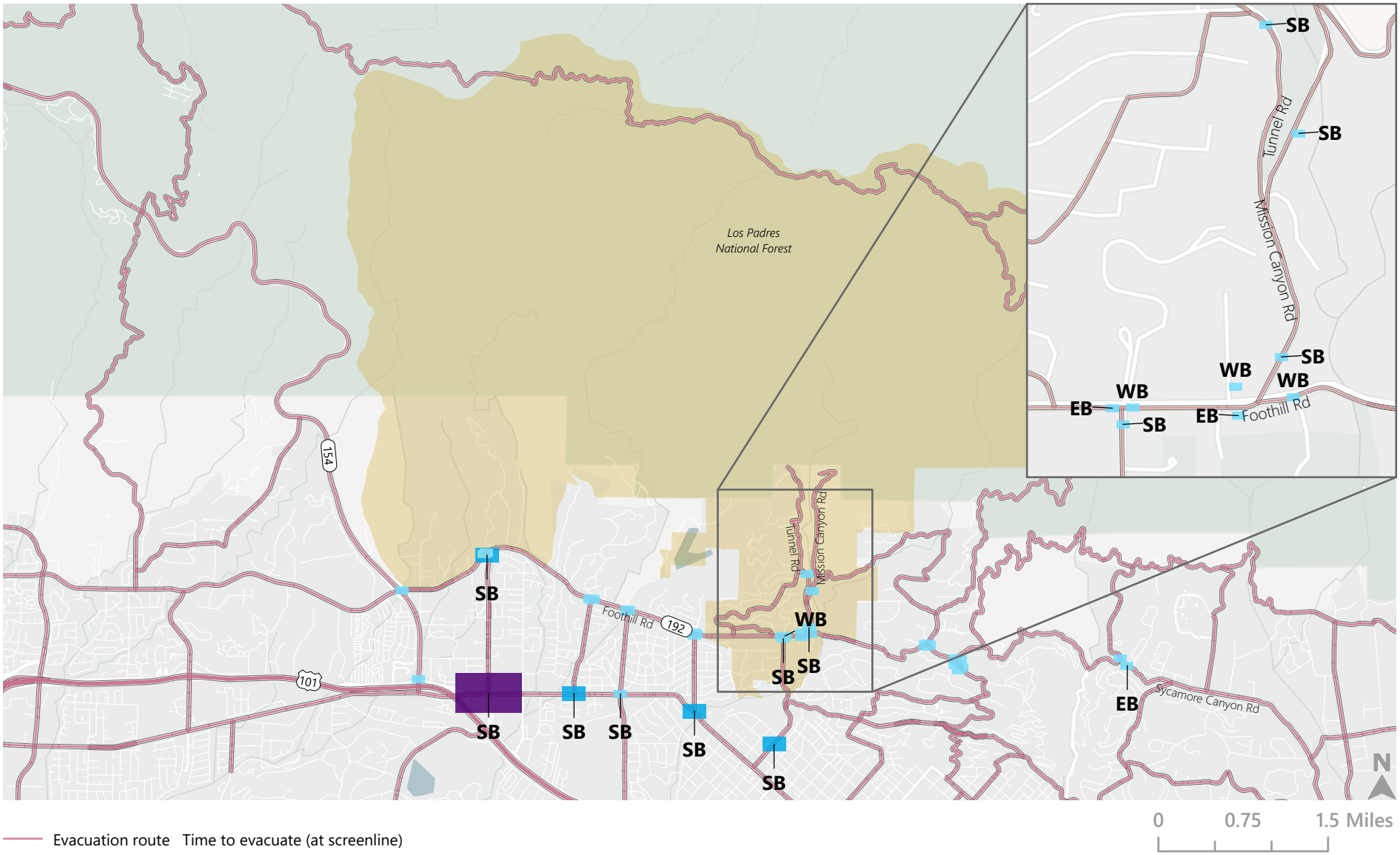

Figure 6

Scenario Three Evacuation Analysis Results (Western ignition point, weekday)

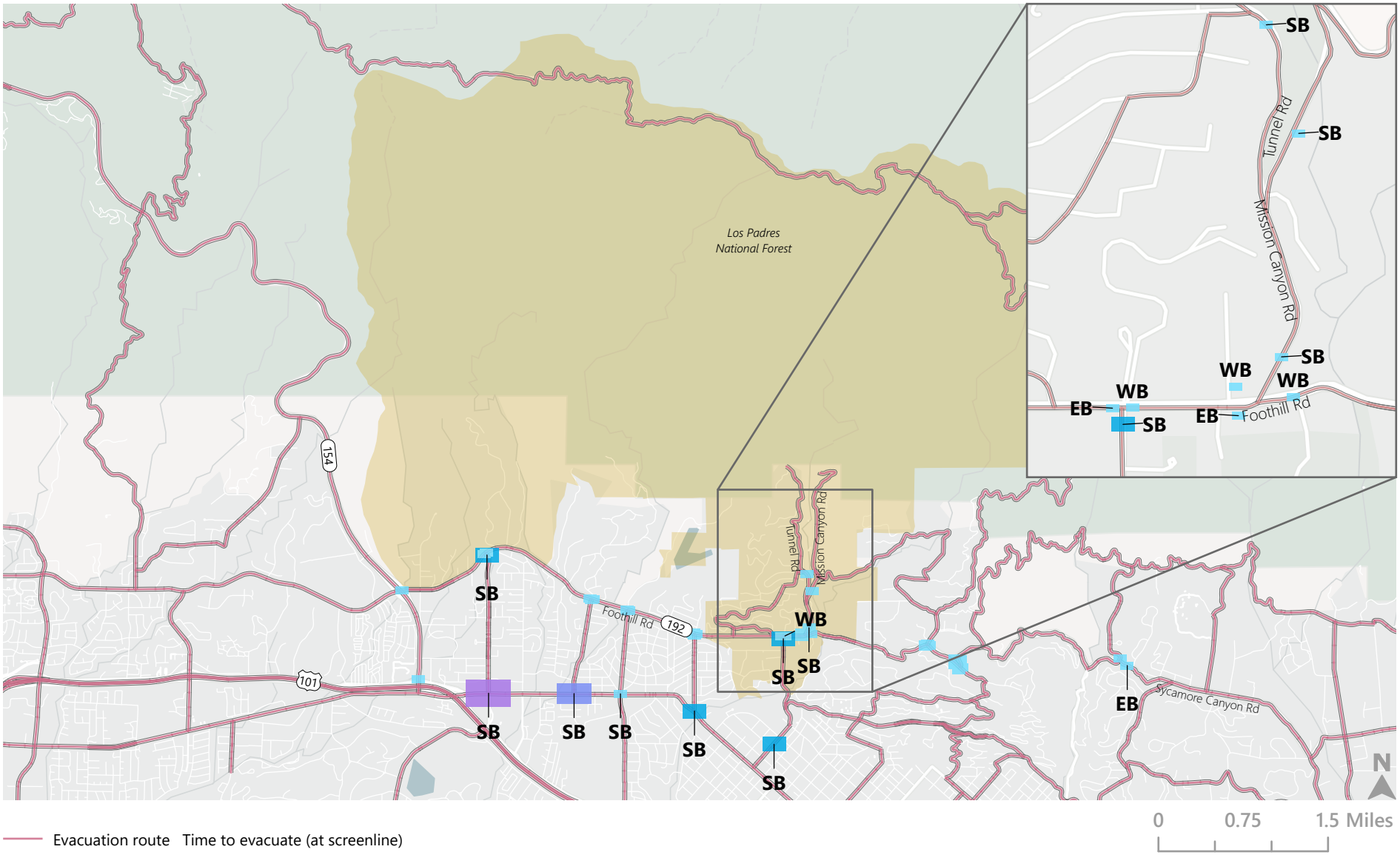

Figure 7

Scenario Four Evacuation Analysis Results (Western ignition point, weekend)

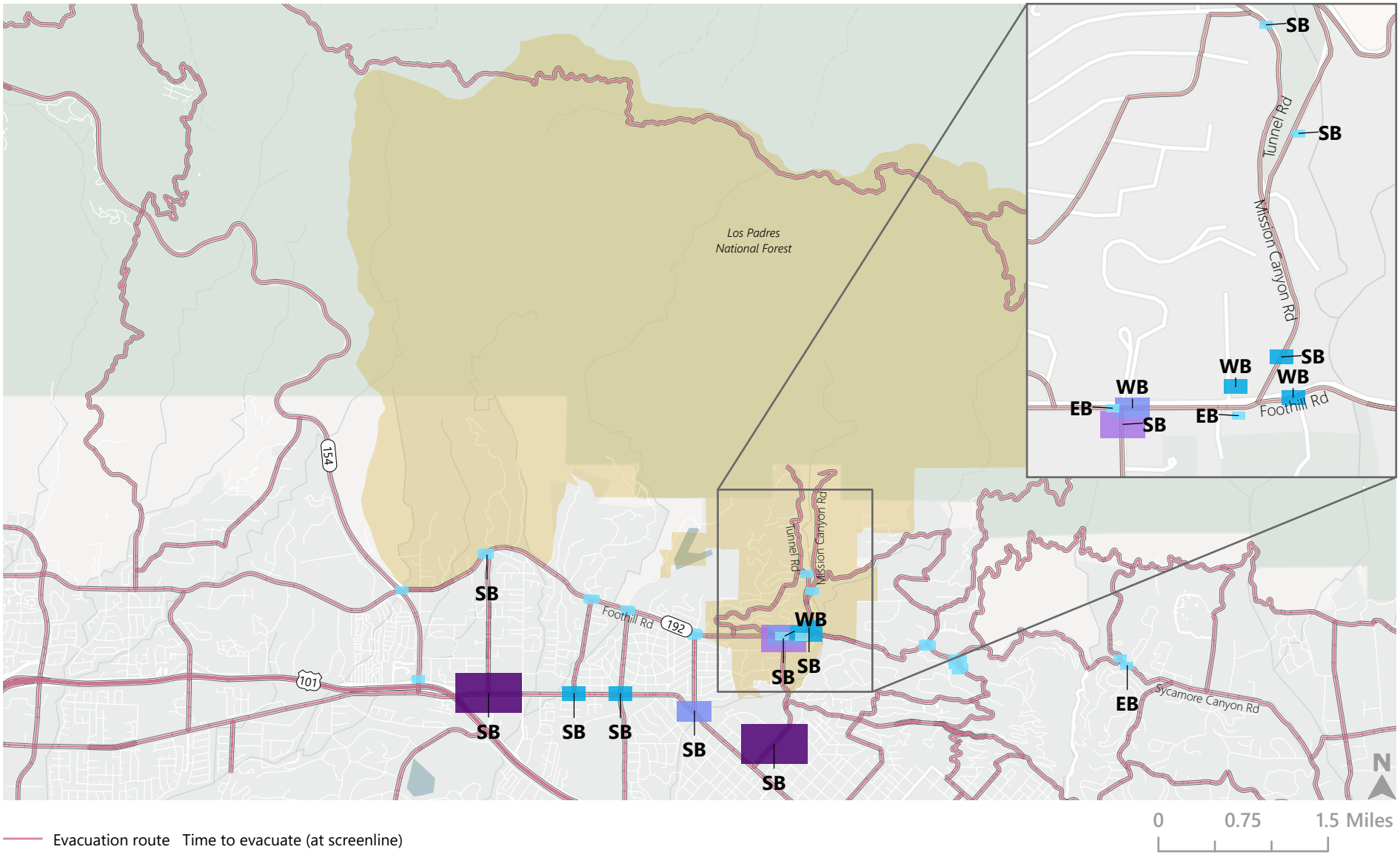

Figure 8

Scenario Five Evacuation Analysis Results (Eastern ignition point, weekday)

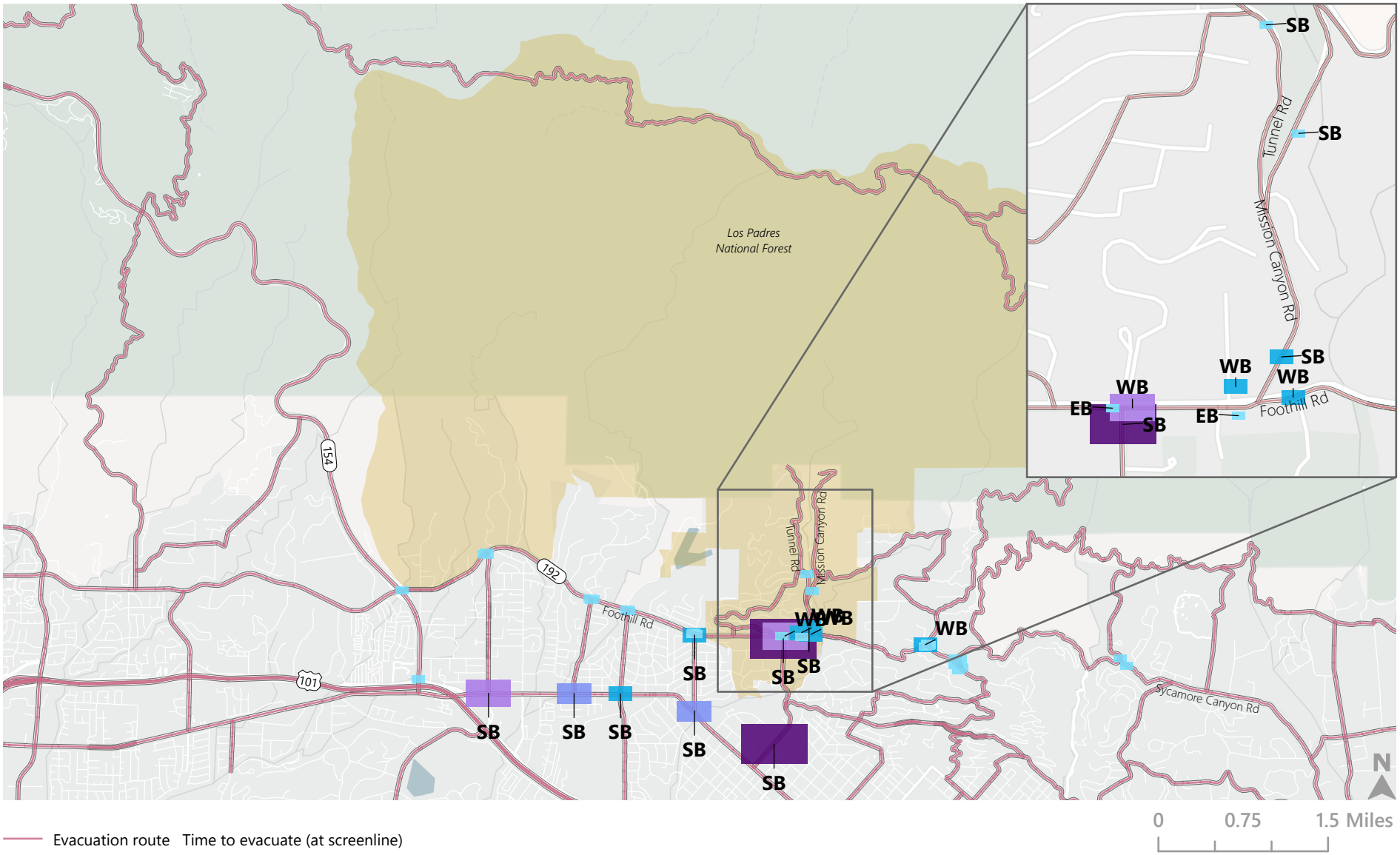

Figure 9

Scenario Six Evacuation Analysis Results (Eastern ignition point, weekend)

3. Study Recommendations

The goal of this study's recommendations is to improve evacuations within the plan area by managing vehicle demand, efficiently using roadway capacity, and providing the public with information—both ahead of time and in real-time during an evacuation event. Due to topographic constraints, this community lacks the ability to expand roadway capacity, and therefore many of the study recommendations focus on planning and programmatic efforts. There are some opportunities for infrastructure-related projects as well. Discussion of recommendations is organized by whether the suggested action addresses evacuation time by better **managing demand** (demand-side), creating more **roadway capacity** (supply-side), or providing people with relevant and timely **information** (information-side). A future phase of work could use dynamic modeling techniques to understand the relative effectiveness of the recommendations on the total estimated time to evacuate the plan area.

3.1 Demand-Side Recommendations

On the **demand** side, opportunities identified to reduce overall evacuation travel demand include efforts that would consolidate evacuating residents into fewer vehicles or distribute traffic across more routes. In community meetings, residents shared that they try to evacuate as many of their vehicles as possible, so the analysis assumed a 1:1 relationship between the average number of household vehicles and the number of evacuating vehicles. The Santa Barbara County Fire Safe Council (SBCFSC) could partner with community members to recommend households evacuate in a single vehicle if possible and incorporate this information into evacuation preparedness education and evacuation alerts. This program could include identification of a staging area in the community (but outside zones likely to require evacuation) in which residents could "pre-evacuate" and park any additional vehicles during high-wildfire-risk days. This would allow community members to feel confident that they have the vehicles they need during an evacuation, while reducing demand on the network during the actual evacuation itself. There may also be an opportunity for the Santa Barbara County Transportation Division (SBC Transportation Division) to coordinate with the Wood Glen Senior Living facility to develop an evacuation plan that could utilize larger buses to efficiently evacuate residents in fewer vehicles. Other efforts to reduce overall evacuation travel demand include incorporating information into existing evacuation preparedness campaigns about considering fire hazard conditions when scheduling gardening and home maintenance services to reduce the number of vehicles in the plan area on Red Flag Warning days and prompting local planning, building and safety, and fire agencies to consider modifications to maps in areas known to have evacuation challenges based on the latest CAL Fire Fire Hazard Severity Zone maps in the SRA and LRA.

To encourage greater distribution of traffic across available evacuation routes, the SBC Transportation Division could explore options for installing a system of sensors that would assess traffic conditions and detect incidents on evacuation routes. This technology could be used to provide real-time travel information to people evacuating the plan area, enabling them to make more informed routing decisions and potentially avoid bottlenecks. As a Transportation Systems Management and Operations (TSMO) strategy, real-time

traffic and incident monitoring could offer benefits beyond an evacuation context, reducing congestion and improving traffic flow on a day-to-day basis.

Table 6 summarizes the demand-side recommendations, responsible parties and partners, and the relative priority of the recommendation.

Table 6: Demand-side Recommendations

Recommendation	Strategy Type	Responsible Party/Partnerships	Priority
Develop an evacuation vehicle demand reduction strategy to encourage households to evacuate in a single vehicle when possible.	Plan	Public Works (County Roads), County Planning, SBC OEM, SBC Fire, SBCFSC, community members	Medium
Develop an evacuation plan for the Wood Glen Senior Living facility.	Plan	SBC Transportation Division, Wood Glen Senior Living*, SBC Fire, SBCFSC	High
Work with recreational facilities and other guest-oriented businesses to develop evacuation plans and preparedness for wildfire.	Plan	SBC Fire, SBCFSC, SBC OEM	Medium
Explore options for installing a system of sensors to enable real-time traffic and incident monitoring and provide dynamic travel information.	Project	SBC Transportation Division, California Highway Patrol, SBC OEM, SBC Sheriff's Office	Low
Incorporate information into existing evacuation preparedness campaigns about considering fire hazard conditions when scheduling gardening and home maintenance services to reduce the number of vehicles in the plan area on Red Flag Warning days.	Program	SBC OEM, SBC Sheriffs, SBCFSC	Medium
When CAL FIRE releases updated Fire Hazard Severity Zone maps in the SRA and LRA, local planning, building and safety, and fire agencies should review and consider modifications to the maps in areas known to have evacuation challenges and experience strong, sundowner wind events.	Plan	County Planning, SBC Fire, SBC Sheriff	High

Note: SBC Fire = Santa Barbara County Fire Department; SBCFSC = Santa Barbara County Fire Safe Council; USFS = U.S. Forest Service; * = lead party.

3.2 Supply-Side Recommendations

On the **supply** side, high priority actions to consider include developing an evacuation intersection traffic management plan, conducting roadside fuel reduction, and removing or pruning hazardous trees. The evacuation intersection traffic management plan has multiple components, the simplest of which would be to restrict left turns from Foothill Road at unsignalized intersections (between Cieneguitas Road in the west and Mission Canyon Road in the east). Left turns typically slow down traffic as drivers must wait for a gap in perpendicular traffic, so concentrating left turns at signalized intersections could help to improve traffic operations under evacuation conditions. Encouraging right turns onto Foothill Road could also help better distribute traffic across the north-south evacuation routes south of Foothill Road. La Cumbre Road, Alamar Avenue, and Mission Canyon Road/Los Olivos Street currently have greater estimated evacuation travel demand than State Route 154, Ontare Road, and San Roque Road. Roadside fuel reduction, which refers to reducing the amount and continuity of burnable vegetation, and hazardous tree removal, could be prioritized in the areas where the greatest evacuation travel demand was identified.

Other supply-side recommendations include exploring the feasibility of a curbside management system to help enforce parking restrictions on Red Flag Warning days, coordinating with owners of private/unmapped roads to maintain them as viable egress routes and allow for their use during an evacuation (which could be particularly beneficial to Mission Canyon residents), and studying the feasibility of installing roundabouts at Foothill Road/Mission Canyon Road (the intersection with Mission Canyon Road south of Foothill Road) and Foothill Road/Alamar Avenue). Well-designed roundabouts can improve traffic flow (relative to a signalized or side street stop-controlled intersection), are resilient to power outages, and have safety benefits for all road users (including pedestrians and bicyclists) that could result in benefits during everyday conditions.[11]

Table 7 summarizes the supply-side recommendations, responsible parties and partners, and the relative priority of the recommendation.

[11] FHWA, "Roundabouts." https://highways.dot.gov/safety/intersection-safety/intersection-types/roundabouts.

Table 7: Supply-side Recommendations

Recommendation	Strategy Type	Responsible Party/Partnerships	Priority
Develop an evacuation intersection traffic management plan 1. *Restrict left turns from Foothill Road at unsignalized intersections between Mission Canyon Road and Cieneguitas Road* 2. *Signal modifications activated during evacuation events (i.e. extending green time for protected left turns, "green wave" outbound) onto La Cumbre Rd, Ontare Rd, San Roque Rd, and Alamar Ave* 3. *Restrict Foothill Road to evacuation traffic only between State Route 154 and Sycamore Canyon Road* 4. *Deploy manual traffic control officers at N Mission Canyon & Foothill Rd and S Mission Canyon & Foothill Rd during an evacuation*	Plan	SBC Transportation Division, SBC Fire, County Planning, SBC OEM, SBC Sheriff's Office	High
Identify trigger points for closing surrounding highways to through traffic. Criteria to consider include: • *Number of homes confirmed to have ignited* • *Number of evacuation zones issued formal evacuation order*	Plan	SBC Fire, California Highway Patrol (CHP), SBC OEM	High
Conduct roadside fuels reduction along major roadways.	Program	SBC Fire, SBC Transportation Division, Caltrans	High
Identify and remove or prune hazardous trees along major evacuation corridors to maintain vertical clearance.	Program	SBC Fire, SBC Transportation Division, private property owners	Medium
Identify private/unmapped roads and coordinate with appropriate stakeholders to maintain them as viable egress routes and allow for their use during an evacuation.	Project	SBC Transportation Division, SBC Fire, private property owners	Low
Study feasibility of converting intersections to roundabouts (candidates include Foothill/S Mission Canyon, Foothill/Alamar)	Project	SBC Transportation Division, Public Works (County Roads)	High
Explore the feasibility of a curbside management system along roads north of Foothill used for recreational and visitor parking to help enforce parking restrictions on Red Flag Warning days. Elements of the system would include: • *A registration requirement for people to park at trailheads, enabled through a mobile app.* • *Prohibit registering (and parking) on Red Flag Warning days, serving as an extra layer of communication about fire risk to visitors.*	Project	SBC Transportation Division, SBC Fire	Medium

Note: SBC Fire = Santa Barbara County Fire Department; SBCFSC = Santa Barbara County Fire Safe Council; USFS = U.S. Forest Service.

3.3 Information-Side Recommendations

Providing residents, workers, and visitors with **information** that is relevant, timely, easy to access, and easy to understand is a critical component of improving evacuations, and one of the most noted suggestions during stakeholder outreach for this project. High priority information-side recommendations to consider include promoting information about evacuation routes, traffic restrictions to expect during an evacuation, and how to sign up for local emergency alerts and warnings. Ongoing educational campaigns conducted via online and mail channels could be coupled with annual in-person evacuation preparedness workshops to create more comprehensive learning opportunities. Efforts to target new residents upon move-in can also be beneficial since they may have less experience with evacuation events compared to longtime residents. The Santa Barbara County Fire Department (SBC Fire) is likely best positioned to lead such campaigns in partnership with the SBCFSC and SBC OEM.

During community meetings, many residents expressed interest in having a single web-based point of information that could provide real-time updates on the status of wildfires and evacuation route conditions. The County is currently in the process of developing an emergency communication platform using Genasys, which could address the requests for a web-based supplement to existing emergency alerts.

Table 8 summarizes the information-side recommendations, responsible parties and partners, and the relative priority of the recommendation.

Table 8: Information-side Recommendations

Recommendation	Strategy Type	Responsible Party/Partnerships	Priority
Create wildfire evacuation education materials that incorporate Transportation Study findings.	Project	SBC Fire, SBCFSC Mission Canyon Association, property management companies, community groups	High
Incorporate Transportation Study findings into wildfire education campaigns (e.g. Ready! Set! Go!) • *Promote information about available evacuation routes, County-identified temporary areas of refuge and temporary evacuation points, and traffic restrictions to expect during an evacuation.* • *Promote information about how to sign up for local emergency alerts and warnings.* • *Highlight how evacuation preparedness makes evacuation easier on everyone by spreading out evacuation traffic.*	Project	SBC OEM*, SBC Fire, SBCFSC	Medium
Conduct annual educational seminars to educate residents on wildfire preparedness. Educational topics will include: • *Defensible space* • *Structural hardening and retrofits* • *Evacuation* *Vegetation management techniques, including mechanical, manual, herbicides, prescribed fire, and herbivory*	Program	SBC Fire, SBCFSC, Firewise, SBC Sheriff, SBC OEM	High
Promote the County's single web-based point of information (including using Genasys during evacuations) regarding wildfire status and evacuation orders/warnings. Coordinate with partner services (SBC Fire, USFS, County of Santa Barbara, The Nature Conservancy, Santa Barbara Land Trust, and others) to ensure information is shared and consistent.	Project	SBC OEM, SBC Fire, SBCFSC, adjacent fire agencies and partner agencies	High
Identify areas to install evacuation wayfinding signage.	Project	SBC Transportation Division	High
Incorporate an early notification system for parcel clusters with a single egress route into evacuation notification systems (e.g. Genasys).	Program	SBC OEM	High

Note: SBC Fire = Santa Barbara County Fire Department; SBCFSC = Santa Barbara County Fire Safe Council; USFS = U.S. Forest Service; * = lead party.

4. Conclusion

The purpose of this Transportation Study is to identify areas within the Santa Barbara Foothill Communities that may have limited access and egress during an evacuation event and provide recommendations to improve emergency access and resident/worker/visitor evacuations. To achieve these goals, Fehr & Peers estimated the amount of time it may take for all vehicles to evacuate the plan area and used this data to identify potential bottlenecks in the transportation network. The roadway capacities of the evacuation routes in the plan area were examined and compared to the expected evacuation travel demand under six evacuation scenarios.

- **Scenario One:** Central ignition point on a weekday afternoon
- **Scenario Two:** Central ignition point on a weekend, midday
- **Scenario Three:** Western ignition point on a weekday afternoon
- **Scenario Four:** Western ignition point on a weekend, midday
- **Scenario Five:** Eastern ignition point on a weekday afternoon
- **Scenario Six:** Eastern ignition point on a weekend, midday

The results of the evacuation analysis informed the following key takeaways.

1. **Evacuation traffic will be greatest in the southern portion of the Mission Canyon community:** Across all three scenarios, the results of the analysis suggest traffic will be greatest on Mission Canyon Road south of Foothill Road heading southbound. Additional bottlenecks under a subset of scenarios may occur at Mission Canyon Road heading southbound after Tunnel Road and Mission Canyon merge, and at Foothill Road heading westbound to turn south onto Mission Canyon Road.
2. **Single access residential areas are likely to require the most time to evacuate:** The evacuation results suggest that everyone evacuating from the single access residential areas along Tunnel Road north of Cheltenham Road and along Mission Canyon Road north of Las Canoas Road would be able to reach Foothill Road within two hours under Scenarios One, Two, Five, and Six and within an hour under Scenarios Three and Four.
3. **Weekend evacuation travel demand may be greater than weekday demand:** Regardless of ignition point, greater evacuation travel demand is expected under a weekend scenario compared to a weekday scenario. This greater demand is also reflected in longer estimated evacuation times on weekends.
4. **The location of the ignition point may impact evacuation times in the Mission Canyon community:** Although overall estimated evacuation travel demand is highest under the central ignition point scenarios, the eastern ignition scenarios produce the greatest individual level of localized traffic in the Mission Canyon portion of the plan area.

Based on the evacuation analysis findings, recommendations were developed to improve evacuations within the plan area by managing vehicle demand, efficiently using roadway capacity, and providing the public with information—both ahead of time and in real-time evacuations. There are some opportunities for infrastructure-related projects, however many of the study recommendations focus on planning and programmatic efforts due to the plan area's limited options for expanding roadway capacity. High priority actions to consider include developing an evacuation vehicle demand reduction strategy, developing an evacuation intersection traffic management plan, and promoting the single web-based point of information regarding wildfire status and evacuation orders/warnings that the County is developing using Genasys. Collaboration between the Santa Barbara County Fire Department, the Santa Barbara County Fire Safe Council, the Santa Barbara County Transportation Division, the Santa Barbara County Office of Emergency Management, and community members will be a key component of implementing this study's recommendations. A future phase of work could use dynamic modeling techniques to understand the relative effectiveness of the recommendations on the total estimated time to evacuate the plan area.